Section 7

Operations Readiness Approach

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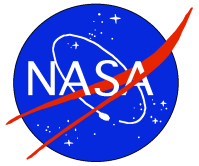
Outline



- Organization
- Plans
- Documents
- Product Development
- Configuration Control
- Testing and Training
- Simulations

Organization

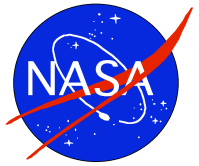
- ***Ground System Operations Manager has Lead Responsibility for Operations Readiness***

- ***All Parties in the Ground System/Mission Operations Group are involved in Operations Readiness***
  - *Ground Systems Team*
  - *Flight Operations Team*
  - *Spacecraft Contractor (SAI)*
  - *Instrument Teams*

Operations Readiness Approach

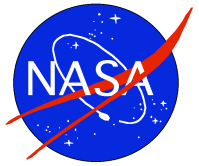
- ***Operations Reviews:***
  - *Mission Ops Review (MOR) will present plan for achieving ops readiness*
  - *Operations Readiness Review (ORR) will be where we demonstrate that the operations team, products, and processes are ready for launch*
- ***Operations product generation/validation joint responsibility of Spectrum, Instrument and Flight Operations Teams***
  - *BUT, Spectrum and Instrument Teams responsible for signing off on ALL command PROCs (and other ops products as appropriate)*
- ***Readiness of operations team, products and processes to be validated via a series of Mission Simulations and L&EO Rehearsals***
  - *Utilizes combination of simulators (primarily MTS and Hot Bench) and actual observatory*

Operations Readiness Approach



- ***Formal training to be provided by the spacecraft contractor (of the FOT)***
  - *FOT will have to go through a certification process established by Spectrum Astro on their spacecraft proficiency*
  - *FOT will also have their own certification process for ground system proficiency*
- ***FOT will also provide MOC training to the spacecraft and instrument team personnel (for L&EO support)***
- ***Operations products (e.g., command PROCs, data base, display page definitions) to be under the control of the Operations CCB***
  - *Products will be CM controlled on the MOC system via a CM software package, such as CVS (like Swift)*

Plans



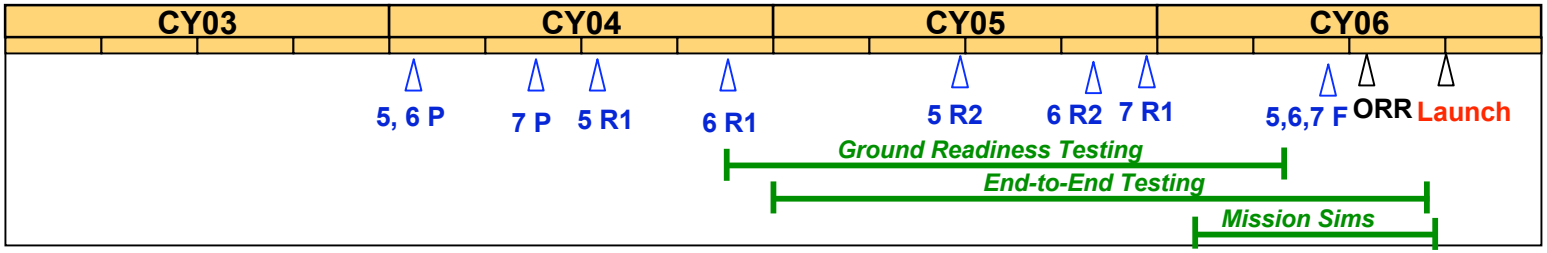
- ***Operations Agreements for Roles and Responsibilities***
  - *Defines Roles and Responsibilities for personnel involved in achieving Operations readiness*
- ***Mission Operations Readiness Plan provides detailed descriptions of how the operations products will be developed and validated, and how overall ops readiness will be achieved***
  - *For each product:*
    - *Who is responsible for delivery*
    - *How it is controlled prior to CM*
    - *What are the criteria for submission into the CM System*

Plans

- ***MOC Certification Plan defines how MOC will become Certified for Launch and Operations***
  - *Defines personnel proficiencies and system reliability criteria required Launch and Mission Operations*
  - *Document will be generated and maintained by the FOT Lead*
- ***Sustaining Engineering Plan describes support in the post launch era***
  - *Defines which elements provide what level of sustaining engineering support and criteria for calling up additional support for the life of the mission*
  - *Document will be generated and maintained by the FOT Lead*

Documents

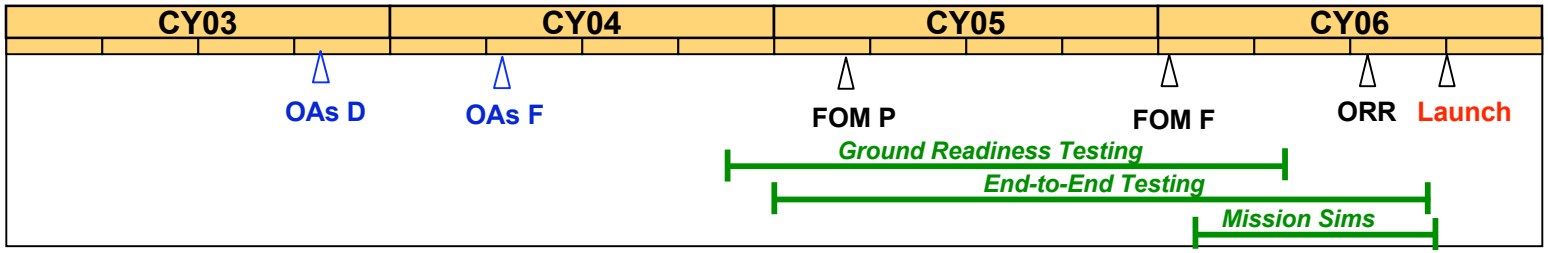
- ***Spectrum Astro delivering 3 primary operations documents (CDRL's)***
  - *CDRL #5: Observatory Operations Description Manual*
  - *CDRL #6: Telemetry and Command Handbook*
  - *CDRL#7: Flight Operations Plan*
- ***Instrument teams required to deliver Instrument Operations Manuals and Operations Procedures (normal and contingency ops)***



P = Preliminary, R# = Revision Number, F= Final

Documents

- **FOT delivering collection of operations documents:**
  - *Flight Operations Manual*
    - *How to fly the observatory using the ground system*
  - *Operations Agreements (primarily with SSC and IOC's)*
    - *Define details of interactions of individuals with the organization*
    - *Define expectations of when products will be delivered*
    - *Define latency requirements and contingency scenarios*



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Ops Product Development

- **Page and graphic Displays**
  - *Each element's local operations team will generate appropriate displays for use in their location*
    - *FOT will generate displays for the MOC*
    - *All elements will be able to function using these displays*
      - *Requires interchange on ITOS system such as during MOC training*
- **Command PROCs**
  - *Spectrum and instrument teams will provide written (non-STOL) operational procedures (L&EO/activation, contingencies, normal ops)*
  - *FOT will generate the executable ITOS PROCs and perform initial check-out*
- **Project Database (PDB)**
  - *Spectrum will provide a fully validated, ITOS formatted, observatory T&C database to the MOC*
  - *FOT will add MOC-specified files to generate the PDB*

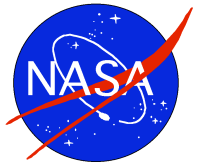
Ops Product Validation

- **Page Displays**
  - *FOT will work with Spectrum and Instrument Teams to:*
    - *Determine required content*
    - *Format data on pages*
- **Command PROCs**
  - *Spectrum and instrument teams will have to work with FOT to validate the PROCs and sign off on ALL Observatory PROCs*
    - *Ground Configuration PROCs do not require signatures outside the MOC*
  - *All PROCs will be validated against Hot Bench, appropriate ones also against spacecraft*
    - *Hot bench has sufficient fidelity in most cases to qualify PROCs for flight*
  - *Majority of instrument functions accomplished via on-board tables, so number of actual instrument PROCs is expected to be relatively small*
  - *FOT direct participation in Observatory I&T (using MOC equipment)*
    - ***Having MOC systems in the I&T facility will be a BIG HELP!***

Ops Product Validation

- **Project Database**
  - *Spectrum Astro and the Instrument Teams primarily responsible for validating that the contents of the data base are correct*
    - *Validation ensures that the bits sent or received perform the desired action or display the proper value*
    - *Validation of the respective portions of the database is performed during Instrument and Observatory simulation and I&T activities*
  - *FOT primarily responsible for verifying that ITOS is correctly turning command mnemonics into command bit patterns*
    - *Verification assures that the same stimuli produce the same effects in ITOS as AstroRT*
    - *The Bottom line – both validation and verification of the databases are a joint effort*
  - *However, Spectrum is at all times "in charge of "the OBSERVATORY Telemetry & Command portions of the PDB, i.e., not the ITOS portions*
    - *From pre-launch and through L&EO*
    - *After L&EO, control of entire PDB migrates to MOC/FOT*

Configuration Control



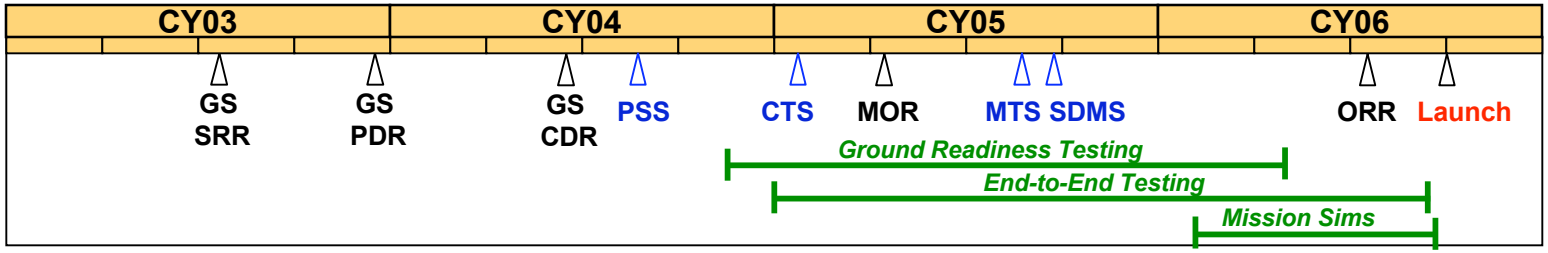
- ***Operations products will be placed under the control of the Operations Configuration Control Board when they have reached sufficient maturity***
  - *CCB Chaired by Ground System Operations Manager*
  - *The Configuration Control Board will provide configuration management*
    - *Ensures a complete, accurate, timely controlled configuration*
    - *Provides documentation of changes*
    - *Eliminates unnecessary changes and duplicate requests*
  - *Typically Configured Items*
    - *Command PROC's*
    - *Project Database*
    - *Display pages and graphs*
    - *Contingency Procedures*
    - *Activities*
  - *All Configured Items must be CCB approved before their use in a GRT, ETE, Mission Sim, or Launch Rehearsal.*

Tests and Training

- ***Operations Readiness Tests***
  - *Series of operations exercises/tests to validate/verify operations products, e.g., PROCS*
  - *Nominally use MTS or Hot Bench*
  - *Prep for GRT, ETEs, Mission Sims and Launch Rehearsals*
- ***Training***
  - *FOT will receive formal training FROM the Spectrum Astro, Inc.*
    - *Certification process established by Spectrum Astro for FOT to demonstrate its spacecraft proficiency*
  - *FOT will provide MOC training TO the spacecraft, instrument team, project or any other personnel who will participate in the launch or mission critical operations.*
    - *FOT will also have their own certification process for ground system proficiency*
    - *All personnel will have to be certified to participate in the launch*

Simulators

Simulator	Provider	Use	Schedule
Portable Spacecraft Simulator (PSS)	GSFC Code 584	Initial MOC testing, Ground system testing	August 2003
Command and Telemetry Simulator (CTS)	Spectrum	Initial MOC/spacecraft interface testing (1553 bus only)	January 2005
MOC Training Simulator (MTS)	Spectrum and Instrument Teams	FOT training, Ops simulations, Ops product development/test	September 2005
Spacecraft Hot Bench	Spectrum	For activities requiring spacecraft high fidelity simulator support (e.g., selected contingency simulations)	To Goddard Post-launch (but available starting at S/C I&T)
Software Development and Maintenance Simulator (SDMS)	Spectrum	Flight software maintenance	September 2005



Simulations

- **Mission Simulations**
  - *Goal is to verify participants readiness for a particular mission phase or critical activity*
  - *Will simulate normal and contingency activities*
  - *Will use ONLY validated, CCB approved products*
  - *Primarily to be run against the MTS simulator but will use the Hot Bench as required or desired for better fidelity.*
- **Launch Rehearsals**
  - *Goal is to verify launch countdown activities*
  - *Everybody involved in the "real" activity participates*
    - *In the role and location they will be at when it happens*
  - *Scheduled by KSC*